

Monitoring Water Vapor Saturation on the Space Station

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Environmental control on the space station relies on circulation to prevent the accumulation of hazardous gases in isolated pockets of air. High local concentrations of water vapor, in addition to posing a risk of condensation, are an indicator of stagnant air. Accurately measuring local humidity concentrations requires a reliable, fast measurement technique suitable for environments ranging from very dry to near saturation. Intrinsically more reliable than relative humidity sensors, chilled-mirror dewpoint hygrometers are commonly used in the laboratory for accurate humidity measurement. We have developed a miniature hygrometer that uses a tiny quartz crystal to detect condensation with two orders of magnitude higher sensitivity than the optical methods employed by chilled mirror instruments. In flight experiments conducted on the NASA DC8, SAW hygrometers measured atmospheric humidity transients with a response time over an order of magnitude faster than chilled mirror hygrometers. Recently we integrated a miniature SAW hygrometer into a reference radiosonde, and tested the instrument in flight on a small atmospheric balloon. Further development is required for integration into a handheld instrument and flight qualification to meet NASA's advanced environmental monitoring requirements.

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